

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: George HRADIL

Confirmation No.: 7882

Application No.: 10/763,979

Group Art Unit: 1753

Filing Date: January 22, 2004

Examiner: E. Wong

For: ELECTROPLATING SOLUTION
CONTAINING ORGANIC ACID
COMPLEXING AGENT

Attorney Docket No.: 81394-499

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Commissioner for Patents
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Sir:

I, George Hradil, hereby submit the following comments as a person of ordinary skill in the art of the subject matter of this application.

1. I have ScB, MS, and PhD degrees in Chemical Engineering and over 27 years experience in the field electroplating, starting from a technician to a Research Engineer. I am presently employed by Technic, Inc., the assignee of the present application, and am responsible for formulating electrolytes for plating of various metals as well as for troubleshooting and resolving problems in implementing such formulations for our customers.

2. As the inventor, I am familiar with the present invention, its claims and the office actions that include rejections of such claims.

3. The present invention relates to a method for electroplating a metal deposit on a substrate which comprises contacting a plurality of such substrates with a solution that has a particular pH range and that contains a complexing agent and metal ions in a particular

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ratio range that provides metal electrodeposits on the substrates without causing significant agglomeration of such substrates during electroplating. The pH of the solution is between 3.5 and 5.5, adjusted, if necessary, by the addition of a suitable pH adjusting agent, to form a stable solution and the complexing agent and metal ion are present in a concentration ratio of between about 2:1 and 9:1 to reduce or minimize agglomeration of the substrates during electroplating.

4. I understand that the claims have been rejected as being unpatentable over Japanese patent application 2-301,588 ("the '588 reference") for the reasons set forth in the final office action and related advisory actions. This reference does not disclose the presently claimed critical combination of pH range and concentration ratios. The pH range is not critical in the '588 reference and can range from between 2 and 9. And while a pH of 3.5 to 5.5 is included within that range, there is no importance or criticality attached to it. Furthermore, the examples of the '588 reference have pHs between 6 and 7.5, and this suggests that optimum performance is found when a near-neutral electroplating solution is used. In contrast, I have found that the solutions of the '588 reference are not stable at such near-neutral pHs.

5. By me or under my direction and control, tests were carried out to repeat Example 1 of the '588 patent. The initial making up of the solution of example 1 resulted in a pH of around 1, and base was added as taught by that example to arrive at a final pH of 7. Photographs were taken at various intermediate pH values to illustrate the condition of the solution, and these are attached. As can be easily seen in these photographs, the solution became unstable at pHs of above 5.5 with precipitation of the metal components being observed initially as cloudiness (at a pH of 6) to a precipitate of tin hydroxide in the beaker at a pH of 7. It is not possible to obtain useful metal deposits with unstable solutions of this type. Also, the solution at a preferred pH in the claimed range, i.e., 5, was completely stable as shown by the clear solution in the beaker.

6. My colleague, George Federman, and I presented a technical paper entitled MINIMIZING COUPLING OF SMALL PASSIVE COMPONENTS IN THE ELECTROPLATING OPERATION at a conference in 2004 to present some of the findings of this invention. This paper also shows why the pH range is critical. In particular, Figures 4 and 5

illustrate that improvements in agglomeration (i.e., less coupling) of the parts to be electroplated) are found at pHs above about 3.5 to 4.5, thus confirming the criticality of the lower end of the presently claimed pH range. Furthermore, solutions having a pH below 3.5 become very aggressive to the components or electronic parts to be plated. Thus, these tests demonstrate the criticality of the presently claimed pH range of between about 3.5 and 5.5.


6. It is known in general that increasing the amount of complexing agent can increase the solubility of the metal components in the solution. In the present invention, however, this is not possible because, as noted in the specification, increased amounts of complexing agent causes agglomeration of the substrates to be plated with inconsistent plated deposits being obtained. Thus, the ratio of complexing agent to metal ion is another important feature of the invention to provide good plating results without causing agglomeration of the substrates.

7. The resolution of the problem of substrate agglomeration during electroplating is a significant benefit of the present invention. This is a source of concern to electroplaters worldwide, in particular where relatively small electronic parts are to be plated, and solutions to this problem are needed and desired. Our technical paper (mentioned above) establishes the importance of the concentration ratio in combination with the particular complexing agents defined in the claims for avoiding agglomeration of parts during electroplating. In particular, the present complexing agent based on ascorbic acid (referred to as CeramiStan BR in the paper) was found to be suitable where other complexing agents based on organic acids such as citric and oxalic acids were not suitable. This data supports the unexpected advantages of the presently claimed complexing agent, concentration ratio and pH range.

8. I further declare that all statements made in this declaration of my own knowledge are true and that all statements made on information and belief are believed to be true; and further these statements were made with the knowledge that wilful false statements and the like so made are punishable by fine or imprisonment, or both under Section 1001 of Title 18

of the United States Code and that such wilful false statements may jeopardize the validity of the application or any patent issuing thereon.

Dated this 22nd day of May, 2006


George Hradil

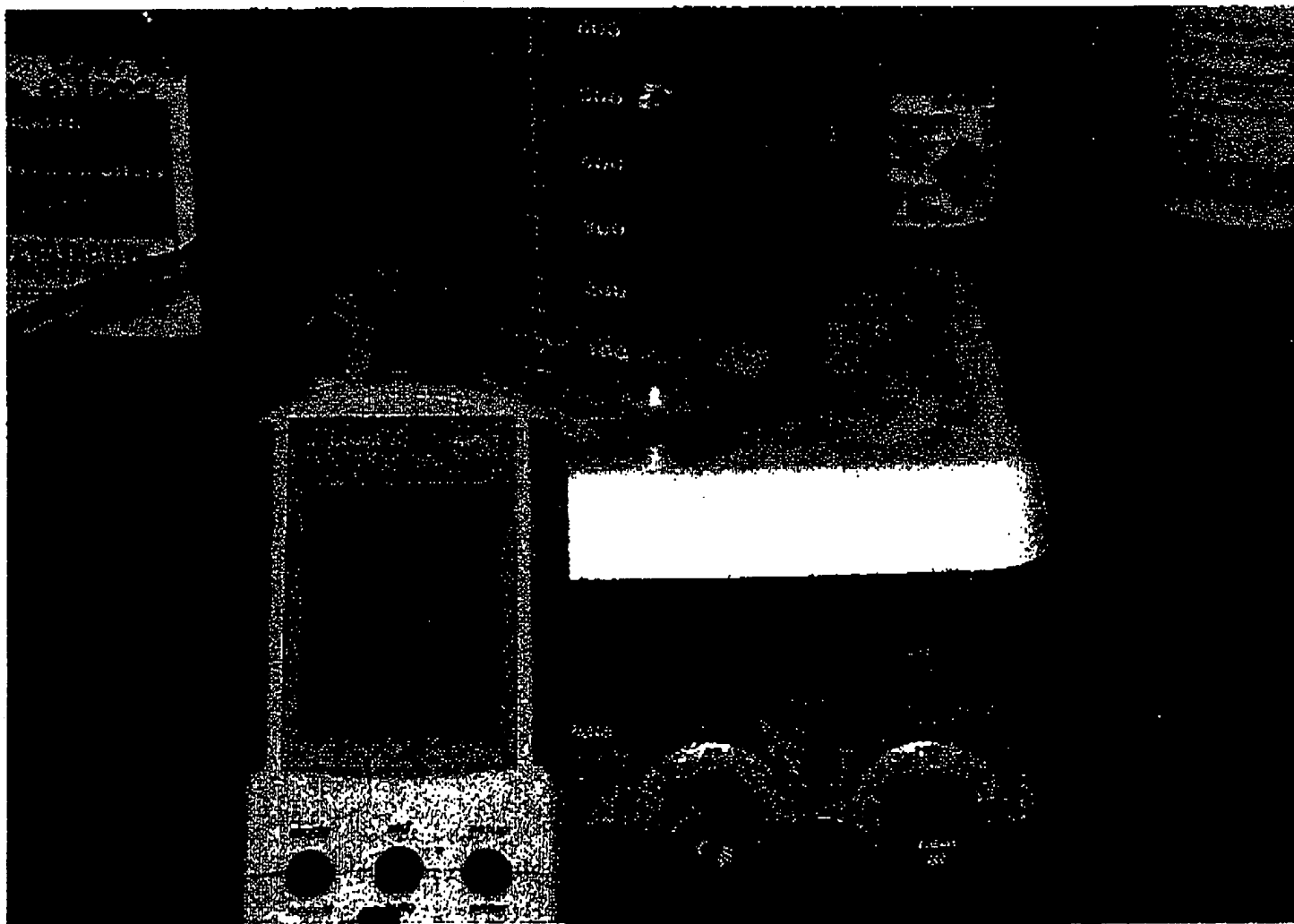
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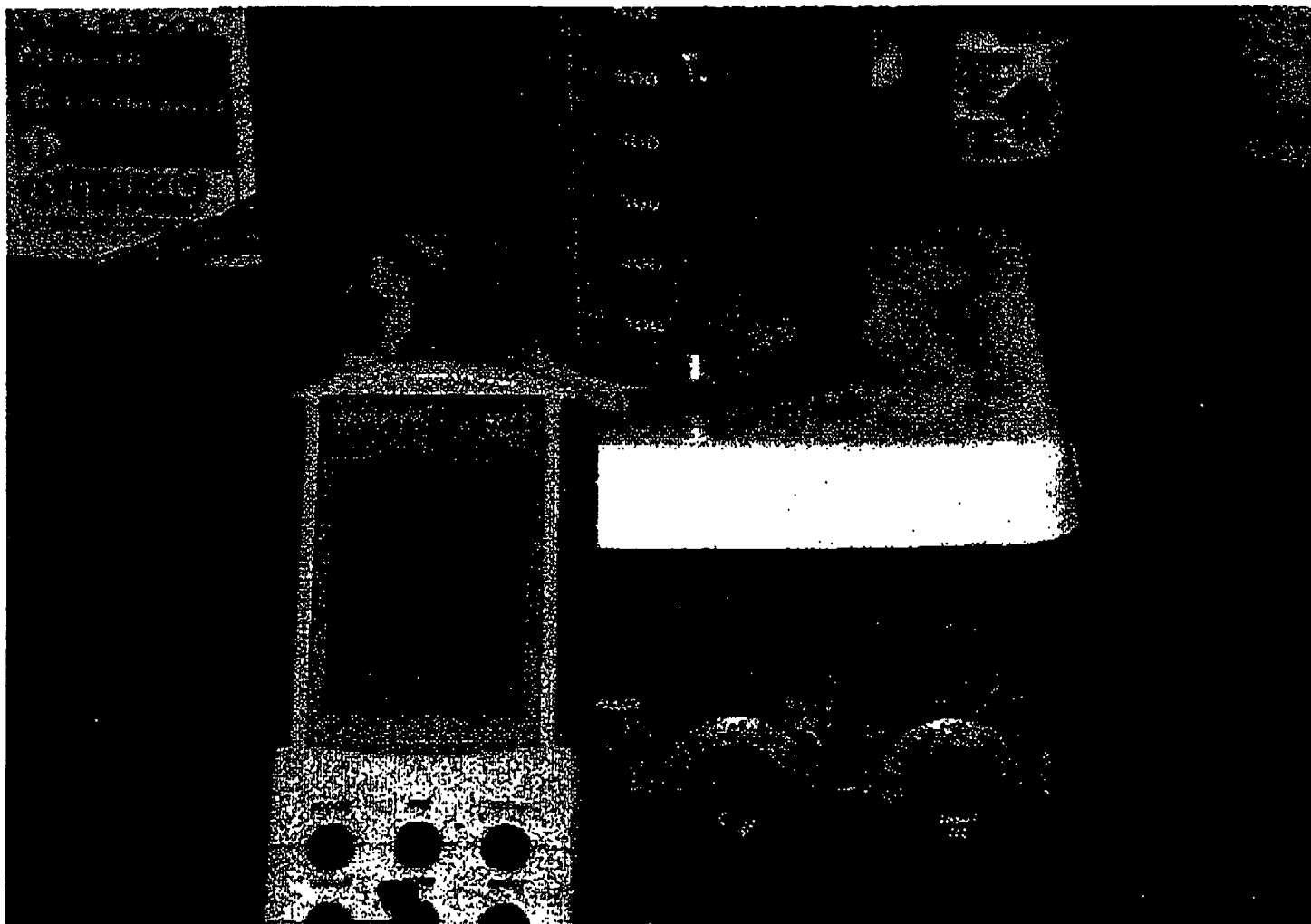
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